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published in
Pacific-Basin Finance Journal
2018

DOI (link to publisher)
10.1016/j.pacfin.2017.04.003

document version
Publisher's PDF, also known as Version of record

Pacific-Basin Finance Journal 52 (2018) 123–133

Contents lists available at ScienceDirect

Pacific-Basin Finance Journal

journal homepage: www.elsevier.com/locate/pacfin

Islamic spot and index futures markets: Where is the price discovery?☆

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ARTICLE INFO

Keywords:
Price discovery
Asset pricing
Islamic stocks
Predictive regression
Investors

JEL classification:
G11
G12
G17

ABSTRACT

This paper examines the source of price discovery for Islamic stocks. We pair a large number of Islamic stocks to country-specific index futures and estimate price discovery using a vector error correction model. The results obtained using data for 19 countries suggest that for most countries (63% of the sample) price discovery is dominated by the spot market. We show that for these countries, a mean-variance investor makes annualized average profit of 4.91% compared to an average buy-and-hold profit of 2.97% per annum.

1. Introduction

In this paper we test whether price discovery is dominated by the Islamic stock market or the index futures market to which these Islamic stocks belong to. The inspiration for this idea has roots in the large empirical literature which has evolved over the last decade-and-a-half, promoted in large part by the influential Presidential Addresses by O'Hara (2003). On Islamic stock markets in particular, Narayan et al. (2016b) test whether price discovery predicts asset prices using a sample of 188 Asia-Pacific Islamic stocks. They show that price discovery matters in pricing stocks. One imminent gap in this Islamic finance literature is the lack of understanding of where exactly the price discovery takes place. In fact, nothing is known about this process at all. Our research question therefore is: Is it the Islamic stock market or the index futures market that dominates the price discovery process? This question is not trivial because understanding the source of price discovery can guide investment decisions.

Our approach to testing for price discovery follows three steps. In the first step, we compile stock-level data comprising of 900 Islamic stocks listed across 19 different markets for the 1982 to 2015 period. We then match this stock-level price data with the corresponding market index futures price data. This gives us a unique spot-futures price dataset. In the second step, we utilize a panel vector error correction model (VECM) recently proposed by Karabiyik et al. (2016) to get panel estimates of price discovery. The main advantage of using this panel approach when compared to the more conventional time series approach is its ability to exploit

☆ Westerlund thanks the Jan Wallander and Tom Hedelius Foundation for financial support under research grant number P2014–0112:1. Westerlund and Karabiyik thank the Knut and Alice Wallenberg Foundation for financial support through a Wallenberg Academy Fellowship.

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http://dx.doi.org/10.1016/j.pacfin.2017.04.003
Received 19 December 2016; Received in revised form 1 March 2017; Accepted 7 April 2017
Available online 08 April 2017
0927-538X/

the information contained in the cross-sectional dimension of our panel, leading to relatively accurate estimates of price discovery. Another advantage of the panel approach to price discovery is its ability to summarize the information contained in a large cross-section of stocks. The country-level panels that we consider contain up to 167 stocks. Imagine trying to report and summarize the results from 167 stock-specific VECMs – a daunting task, to say the least. In the final step, we design a framework that links the evidence of price discovery to investment decision making. We, in particular, show that one can utilize the information on price discovery to forecast returns and devise economically meaningful trading strategies.

We make three main findings. Our first finding is that the price discovery process is dominated by the spot market. This is the case for 12 out of the 19 markets. Our second finding relates to the robustness of the evidence of price discovery. We use both monthly and weekly data, and conclude with the same results, suggesting that the evidence of price discovery we document is insensitive to data frequency. Our third finding relates to the economic significance of price discovery. For the 12 countries for which spot market dominates price discovery, we show that the annualized average profit turns out to be 4.91%, whereas the average buy-and-hold profit is only 2.97% per annum. This represents a 62.35% increase in average profits when using the evidence on price discovery.

Our findings make three contributions to the literature. The first literature our work connects to is that on Islamic finance. Islamic finance research offers an avenue for understanding the behaviour of financial markets from a different perspective. The distinction between Islamic and non-Islamic (or conventional) financial markets have been well-documented and we refrain from repeating what is well-known; see, for instance, Ibrahim (2015) . There has been a surge in research on Islamic finance, attempting to understand this relatively new investment class. In this regard, recent studies have examined the profitability of Islamic markets (Narayan and Phan, 2016;Narayan and Bannigidadmath, 2015; Ashraf and Mohammad, 2014; Al-Khazali et al., 2014), the efficiency of Islamic banks (see Johnes et al., 2014; Belanes et al., 2015), interactions among Islamic equity markets (Yilmaz et al., 2015) and Islamic bond market (Azmat et al., 2014a,b, 2015), the connection between Islamic markets and global crises (Kenourgios et al., 2016), corporate social responsibility (Mallin et al., 2014Abdelsalam et al., 2014), and the predictability of Islamic stock prices (Narayan et al., 2016a).[1] We contribute to this literature by exploring the source of price discovery, which is an important component of the functioning of financial markets. While from previous studies we understand that Islamic stock markets are profitable, Islamic banks are more efficient compared to conventional banks and that Islamic stocks, like conventional stocks, are predictable, from our study we now understand that when it comes to price discovery in Islamic stock markets, in most countries it is the spot market that dominates the price discovery process. In discovering this empirical evidence, our findings are consistent with the trading volume hypothesis, which associates high trading volumes in the spot market (compared to the futures market) to a greater role of the spot market in the price discovery process.

We also connect with the recent study of Narayan et al. (2016a), which is to the best of our knowledge the only study on price discovery in Islamic stocks. This is in fact the study which comes closest to our work although it is completely different in its aims. This other study searches for time-varying price discovery in a wide range of stock price-based portfolios (made up of 188 Asia-Pacific stocks) and then uses this as a predictor of Islamic stock returns. The hypothesis is that time-varying price discovery is able to predict Islamic stock returns, and the authors find strong support for their hypothesis. Our goal is to search for price discovery in Islamic spot and corresponding country futures market price index for 900 stocks belonging to 19 countries. Our study can therefore be seen as complementing the work of Narayan et al. (2016a). In interpreting the connection between our work and that of Narayan et al. (2016a) it is important to note that while we take the classical definition of price discovery Narayan et al. (2016a) depart from this definition. Their point is that as long as stocks belong to the same universe the sum of stocks contribution to price discovery should be 100%.

Our finding of mixed evidence on price discovery documenting a role in price discovery for both spot and futures markets joins studies in other strands of the literature where similar sort of evidence has been found. In particular, the evidence from the commodity market suggests that the process of price discovery is not clear-cut. Dolatabadi et al. (2015) test whether price discovery in the commodity markets is dominated by the spot or the futures market. They find mixed evidence. Moreover, analysing the stock index cash and futures markets, Pizzi et al. (1998) also document mixed evidence on the source of price discovery.[2] Our results seem consistent with this literature.

Our final contribution relates to the economic significance of price discovery. Identifying price discovery is one thing but understanding its economic relevance is another. We design a framework within which one can utilize the information on price discovery to specify return-forecasting models. The relevance of such models is that return forecasts can be utilised to devise trading strategies. We demonstrate that these strategies are meaningful, and are robust to different risk aversion parameters and to the allowance for both short-selling and borrowing. The trading strategy framework we design offers a fresh perspective on understanding the importance of price discovery. In this regard, our paper makes both a statistical and an economic contribution to the literature on price discovery.

We organise the balance of the paper as follows. In Section 2, we discuss the econometric methods used to examine price discovery. Section 3 discusses the dataset and presents the results. The final section provides concluding remarks.

2. Econometric method

The majority of the empirical literature on price discovery analysis has been focusing on time series estimation of price discovery

[1] For some recent studies on Islamic markets, see Shaban et al. (2016), Shamsuddin (2014), and Rahim and Masih (2016).

[2] There are a number of other studies which document strong evidence of price discovery in the spot market; see, inter alia, Bohl et al. (2009), Cabrera et al. (2009), and Chen and Gau (2009).

parameters. However, recently there has been some attempts to use a panel data approach. In this paper we follow this fashion and adopt a panel data approach to price discovery. The theory behind this approach is developed by Karabiyik et al. (2016). They consider the two most popular time series approaches for price discovery and adapt them to a panel data setup. These are the information share (IS) and permanent-transitory (PT) approaches of Hasbrouck (1995), and Gonzalo and Granger (1995), respectively. In order to describe the panel versions of these approaches, denote by $p_{s,i,t}$ and $p_{f,i,t}$ the stock and futures prices of stock $i = 1,\ldots,N$ at time $t = 1,\ldots,T$. We assume that these prices follow the following VECM:

$$\Delta p_{i,t} = \alpha_i p^*_{i,t-1} + \sum_{\ell=1}^{k} A_{i,\ell}\Delta p_{i,t-\ell} + \epsilon_{i,t}, \tag{1}$$

where $p_{i,t} = (p_{s,i,t}, p_{f,i,t})'$, $\alpha_i = (\alpha_{s,i}, \alpha_{f,i})'$, $p^*_{i,t} = p_{s,i,t} - p_{f,i,t}$ and $\epsilon_{i,t} = (\epsilon_{s,i,t}, \epsilon_{f,i,t})'$. It is assumed that the prices are non-stationary; however, $p^*_{i,t}$ is stationary, which means that the two price series' are cointegrated with the elements of α_i measuring the extent of error correction at each market.

Given the above VECM, we can use the Granger representation theorem (see Engle and Granger, 1987) to obtain the so-called "common trends representation" of $p_{i,t}$. In order to do this, we define the orthogonal component $\alpha_{i,\perp} = (\alpha_{s,i,\perp}, \alpha_{f,i,\perp})'$ of α_i, which is such that $\alpha_i'\alpha_{i,\perp} = 0$. The common trends representation has the following general form written as

$$p_{i,t} = B_i\alpha_{i,\perp}' \sum_{n=1}^{t} \epsilon_{i,n} + s_{i,t}, \tag{2}$$

where B_i is a constant and $s_{i,t}$ is a stationary process that depends on $\epsilon_{i,t}$ (and its lags and leads). This representation shows how the prices in the stock and futures markets contain a common random walk term, namely, $B_i\alpha_{i,\perp}' \sum_{n=1}^{t} \epsilon_{i,n}$, and also how the extent to which each market is affected by shocks to this term is determined by $\alpha_{i,\perp}$.

Hasbrouck's (1995) IS measure is based on this representation. It measures the contribution of each market to the total variance of those innovations that have a permanent effect on prices. Let us therefore denote by $\Omega_i = E(\epsilon_{i,t}\epsilon_{i,t}')$ the covariance matrix of the errors in the VECM. Then, the total variance of the innovations that have a permanent effect on prices is given by $B_i^2\alpha_{i,\perp}'\Omega_i\alpha_{i,\perp}$. Suppose that $\Omega_i = C_iC_i'$, where C_i is a lower triangular matrix. This is the so-called "Cholesky decomposition" of Ω_i. The IS of stock i in the spot market is now given by

$$\frac{([\alpha_{i,\perp}'C_i]_1)^2}{\alpha_{i,\perp}'\Omega_i\alpha_{i,\perp}}, \tag{3}$$

where $[\alpha_{i,\perp}'C_i]_1$ is the first element of $\alpha_{i,\perp}'C_i$. It is important to note that the above IS depends on the ordering of the markets. In particular, assuming the correlations between the innovations are positive, the IS of the spot market is maximized (minimized) if the spot price is ordered first (last). The IS computed for each of the two possible orderings gives the upper and lower bound for the IS, which can then be combined by taking the average. The same procedure can be applied to obtain the IS of the futures market.

The PT approach of Gonzalo and Granger (1995) is very similar to the IS approach in that it presumes that the data can be decomposed into a stationary and a random walk component. The main difference is that in the PT decomposition the innovations driving the stationary component are not the same as those driving the random walk component. This is convenient because it means that in the PT approach each market's contribution is independent of the ordering of the prices. PT measure for stock i in the spot market is given by

$$\frac{\alpha_{s,i,\perp}}{\alpha_{s,i,\perp} + \alpha_{f,i,\perp}}. \tag{4}$$

The corresponding measure for the futures market is simply one minus this.

The measures given above are for individual stocks, which are useful when the number of stocks is relatively small and each stock has special significance. In our case we will be considering a large number of stocks and we are not particularly in the price discovery contribution of each stock, which is bound to be very small. In situations like this it makes sense to try to explore the similarities that exists within countries and to pool the information regarding price discovery at the country-level. The assumption that we are going to make is that the error-correcting behaviour of stocks within the same country has one component that is common and one that is idiosyncratic. Formally, if stocks $1,\ldots,N$ belong to the same country, then

$$\alpha_i = \alpha + \eta_i, \tag{5}$$

where η_i is an idiosyncratic error term. Denote by $\alpha_\perp = (\alpha_{s,\perp}, \alpha_{f,\perp})'$ the orthogonal component of α, and let $\Omega = CC' = E(\Omega_i)$. The panel versions of the above IS and PT measures, henceforth denoted PIS and PPT, respectively, are obtained quite naturally by simply replacing $\alpha_{i,\perp}$, C_i and Ω_i by α, C and Ω, respectively. As with the IS and PT measures, PIS and PPT are parameters of the data generating process that are unknown. Valid inference therefore relies on the availability of suitable estimators. Karabiyik et al. (2016) show how such estimators can be constructed, and study their asymptotic and small-sample properties.

Table 1
Summary of the data. This table presents a summary of our dataset. Column 1 lists countries, the number of stocks in each country is noted in column 2, column 3 has the total number of time-series observations, followed in column 4 by the total sample size by country. The last two columns contain information on the start and end dates. The top panel has information on monthly data, while the bottom panel has corresponding information on weekly data.

Country	N	T	$N \times T$	Start date	End date
Monthly					
US	167	405	67,635	1982-04-30	2015-12-31
Taiwan	63	228	14,364	1997-01-31	2015-12-31
Japan	109	328	35,752	1988-09-30	2015-12-31
South Korea	37	236	8732	1996-05-31	2015-12-31
India	97	187	18,139	2000-06-30	2015-12-31
Hong Kong	20	285	5700	1992-04-30	2015-12-31
UK	56	335	18,760	1988-02-29	2015-12-31
Canada	58	196	11,368	1999-09-30	2015-12-31
Malaysia	40	241	9640	1995-12-29	2015-12-31
Thailand	48	117	5616	2006-04-28	2015-12-31
Australia	42	188	7896	2000-05-31	2015-12-31
Indonesia	49	43	2107	2012-06-29	2015-12-31
Poland	14	167	2338	2002-02-28	2015-12-31
Switzerland	20	291	5820	1991-10-31	2015-12-31
South Africa	19	260	4940	1994-05-31	2015-12-31
Turkey	22	128	2816	2005-05-31	2015-12-31
Singapore	10	208	2080	1998-09-30	2015-12-31
France	14	325	4550	1988-12-30	2015-12-31
Sweden	18	131	2358	2005-02-28	2015-12-31
Weekly					
US	167	1758	293,586	1982-04-23	2015-12-25
Taiwan	63	988	62,244	1997-01-24	2015-12-25
Japan	109	1425	155,325	1988-09-09	2015-12-25
South Korea	37	1026	37,962	1996-05-03	2015-12-25
India	97	811	78,667	2000-06-16	2015-12-25
Hong Kong	20	1239	24,780	1992-04-03	2015-12-25
UK	56	1453	81,368	1988-02-26	2015-12-25
Canada	58	851	49,358	1999-09-10	2015-12-25
Malaysia	40	1046	41,840	1995-12-15	2015-12-25
Thailand	48	505	24,240	2006-04-28	2015-12-25
Australia	42	817	34,314	2000-05-05	2015-12-25
Indonesia	49	185	9065	2012-06-15	2015-12-25
Poland	14	723	10,122	2002-02-22	2015-12-25
Switzerland	20	1261	25,220	1991-11-01	2015-12-25
South Africa	19	1128	21,432	1994-05-20	2015-12-25
Turkey	22	556	12,232	2005-05-06	2015-12-25
Singapore	10	903	9030	1998-09-11	2015-12-25
France	14	1412	19,768	1988-12-09	2015-12-25
Sweden	18	567	10,206	2005-02-18	2015-12-25

3. Data and results

3.1. Dataset

Our dataset is unique and has two components. The first is stock-level data, which we obtain from Datastream. The second is the stock price index futures data, which we obtain from Bloomberg. There is no specific database that contains Islamic stock price data. The data therefore need to be manually compiled. This we do; hence, the data are unique. In compiling the Islamic stock price data, we implement a criteria suggested in recent work by Narayan et al. (2016a) and Narayan et al. (2016b). We only consider stocks that have data available from the start date of their country's stock futures index. This selection criteria leads to a sample of 900 Islamic stocks, belonging to 19 countries. To be included into the sample, a stock needs its: (a) total debt divided by trailing 24-month average market capitalization to be less than 33%; (b) cash and interest-bearing securities divided by trailing 24-month average market capitalization to be less than 33%; and (c) accounts receivables divided by trailing 24-month average market capitalization to be less than 33%. Over the sample period we consider (1982 to 2015), there are 85%, 89%, and 91% of time (months) when conditions (a), (b), and (c), respectively, are met. These conditions are consistent with those used in the literature; see also, Narayan et al. (2015).

Table 1 provides a summary of the data. It contains two panels. The upper panel describes our main dataset, which is monthly,

Table 2
List of future market index. This table contains information on the futures market index used for each of the 19 countries. Column 1 lists the specific country in our sample followed in column 2 by the index.

Country	Index
US	S & P 500 Futures Index
Taiwan	MSCI Taiwan Futures Index
Japan	Nikkei 225 Futures Index
South Korea	KOSPI 200 Futures Index
India	Nifty 50 Futures Index
Hong Kong	Hang Seng Futures Index
UK	FTSE 100 Futures Index
Canada	S & P/TSX 60 Futures Index
Malaysia	FTSE KLCI Futures Index
Thailand	SET50 Futures Index
Australia	S & P/ASX 200 Futures Index
Indonesia	SGX MSCI Indonesia Futures Index
Poland	MIDWIG Futures Index
Switzerland	Swiss Market Futures Index
South Africa	FTSE/JSE Top 40 Futures Index
Turkey	BIST 30 Futures Index
Singapore	MSCI Singapore Futures Index
France	CAC 40 Futures Index
Sweden	OMX Stockholm 30 Futures Index

whereas the lower panel describes the same data sampled at a weekly frequency, which is used here as a part of our robustness test. The following features are noteworthy. Beginning with the monthly dataset, we have panels of stocks that vary from 10 (Singapore) to 167 (US). The time period is as small as 43 months (Indonesia) to as much as 405 months (US). The total number of observations fall in the 2080(Singapore) to 67,635 (US) range. With weekly data the number of time series observations are four times more, with a total sample size in the 9030(Singapore) to 293,586 (US) range. The reason we emphasise these statistics is because we have a rich Islamic stock panel dataset, one that has not been utilised previously. This richness should matter when we search for price discovery.

The second dataset that we use contains the stock index futures. We proxy this with the market futures index to which each of the 19-country Islamic stocks belong to. These indices are listed in Table 2.

3.2. Preliminary statistics

Table 3 has descriptive statistics of the data. The upper panel contains the statistics for spot returns at the weekly and monthly frequencies. These statistics are based on an equal-weighted stock portfolio by country. Mean returns, we notice, fall in the −9.26% (Indonesia) to 18.20% (India) range when using weekly data and when using monthly data the range is −9.71% (Indonesia) to 18.40% (India). The variability in volatility as depicted by the standard deviation is as expected with those markets with higher returns associated with higher volatility. Generally, the skewness is negative and the distribution is leptokurtic. These statistics of the data on Islamic stocks are consistent with those reported in earlier studies such as Narayan et al. (2016a), Narayan et al. (2016b), and Narayan et al. (2015).

The lower panel contains descriptive statistics for the future price index returns by country. Three countries (Taiwan, Japan, and Turkey) have negative futures returns; the rest of the futures returns are positive, with the monthly returns falling in the 0.012% per annum (Malaysia) to 10.98% per annum (France) range.

Finally, we estimate the (unconditional) correlation between country portfolio spot returns and the corresponding country futures index returns. The correlations are reported in Table 4 based on both weekly and monthly datasets. The correlations are all statistically different from zero at the 1% level of significance. The correlations are in excess of 0.5 for South Korea (0.52), Sweden (0.52), India (0.54), Japan (0.56), Poland (0.59), Malaysia (0.60), and Turkey (0.63). The remaining countries have correlations that are less than 0.5 and in fact for five countries (Hong Kong, Indonesia, Switzerland, South Africa, and France) the correlation is less than 0.35. Hence, as expected given the descriptive statistics reported in Table 3, the relation between Islamic spot and future returns seems to be heterogeneous across countries. This is expected to lead to differences in price discovery.

3.3. Main findings

Table 5 reports the monthly price discovery results. Based on evidence obtained from the PPT measure, we see that price discovery is dominated by the spot market with the exception of the US and the South Korean markets where only 30% and 0.003%,

Table 3
Descriptive statistics. This table reports selected statistics on weekly and monthly data. The sample mean returns, standard deviation of sample returns, its skewness and kurtosis are reported. The top panel has statistics on spot price returns, while the bottom panel has corresponding statistics on futures returns. The spot price returns are computed as equal-weighted country spot returns.

	Weekly				Monthly			
	Mean	SD	Skew	Kurt	Mean	SD	Skew	Kurt
Spot returns								
US	0.201	4.841	0.045	25.593	0.874	9.628	−0.324	8.528
Taiwan	0.025	5.94	0.092	3.799	0.106	12.916	0.218	4.61
Japan	0.058	4.897	0.13	4.725	0.27	9.787	0.051	2.578
South Korea	0.106	8.376	−0.387	9.979	0.472	17.34	−0.113	8 .474
India	0.35	6.481	0.492	17.222	1.533	13.822	0.232	7.902
Hong Kong	0.052	8.325	0.4	63.755	0.2	18.39	−1.006	42.98
UK	0.108	4.936	−0.575	14.168	0.464	9.943	−1.065	10.13
Canada	0.178	7.045	0.474	28.444	0.73	13.789	0.179	13.948
Malaysia	0.022	6.082	0.348	22.943	0.099	12.968	0.115	10.566
Thailand	0.227	6.518	1.867	76.026	0.995	12.869	1.498	29.554
Australia	0.143	6.865	−11.312	940.172	0.656	13.688	−4.989	207.586
Indonesia	−0.178	7.721	0.15	23.767	−0.809	15.122	−0.631	16 .246
Poland	0.317	6.369	−0.443	27.82	1.378	13.36	0.154	4.104
Switzerland	0.206	4.484	−0.912	21.002	0.893	8.97	−0.799	10 .013
South Africa	0.018	6.145	−0.088	9.396	0.052	12.235	−0.496	4.4
Turkey	0.106	6.261	−0.258	6.061	0.418	13.596	−0.045	8.231
Singapore	0.132	5.857	−8.213	372.308	0.553	11.782	−4.053	97 .119
France	0.173	4.412	−0.153	5.418	0.745	8.695	−0.066	5.649
Sweden	0.175	5.426	−0.398	4.282	0.876	9.348	−0.05	7.002
Futures returns								
US	0.162	2.386	−0.807	7.24	0.706	4.431	−0.901	2.904
Taiwan	−0.001	3.8	−0.165	3.329	−0.014	7.573	−0.182	0 .841
Japan	− 0.021	3.217	−0.255	3.71	−0.085	6.547	−0.158	0 .742
South Korea	0.038	5.678	−0.9	11.625	0.205	11.306	−0.024	3 .735
India	0.158	3.755	−0.484	2.923	0.69	8.603	−0.484	1.758
Hong Kong	0.121	3.634	−0.263	2.4	0.496	7.703	−0.147	2 .421
UK	0.079	2.717	−0.844	11.277	0.321	4.883	−0.351	1.395
Canada	0.079	3.308	−1.058	7.766	0.346	6.082	−0.797	3.089
Malaysia	0	3.91	0.75	21.005	0.001	8.193	0.261	7.249
Thailand	0.091	3.786	−1.114	9.404	0.373	8.324	−1.317	5 .125
Australia	0.086	3.448	−1.576	12.453	0.414	6.591	−1.022	2 .936
Indonesia	0.099	2.823	0.269	3.062	0.392	5.167	−0.768	0.488
Poland	0.176	4.1	−1.194	5.834	0.763	9.565	−0.811	3.315
Switzerland	0.161	3.359	9.247	225.189	0.701	6.497	5.875	72 .293
South Africa	0.063	6.316	2.945	201.586	0.268	12.909	1.246	47 .2
Turkey	−0.006	5.261	−0.424	3.598	−0.068	10.881	−0.493	1.617
Singapore	0.124	3.303	−0.009	5.975	0.484	7.229	−0.339	3 .84
France	0.213	6.073	23.569	760.727	0.915	12.342	11.852	184.901
Sweden	0.079	3.903	−0.619	4.48	0.325	6.856	−0.778	3.295

respectively, of the price discovery is driven by the spot market. The evidence obtained from the PIS measure confirms this. The evidence obtained when using weekly data corroborates the evidence obtained from using monthly data. These results are reported in Table 6. Our main conclusion from this result is that for most countries in our sample the price discovery process is dominated by the spot market – a result that is robust to different data frequencies.

We next consider some possible explanations for our results. The key outcome of our analysis is that while theoretically price discovery is expected to be dominated by the futures market, we discover that with respect to Islamic stocks price discovery for over 60% of countries (in our sample) is dominated by the spot market. The literature is divided on what dictates this type of spot market driven price discovery. The most likely reason for the results we obtain has roots in the so-called “trading volume hypothesis”. This idea is simple and associates price discovery in the spot market to higher trading volumes in the spot market compared to the futures market. This type of arguments have been made in Lo and MacKinlay (1990), Brennan et al. (1993), Chordia and Swaminathan (2000), and Hou (2007). We observe this in our data; on average (for the 12 countries for which spot market dominates price discovery), trading volume is 119 million whereas the average trading volume of the 12 futures indices is only 78 million. Therefore, our results support the trading volume hypothesis.

Aside from trading volume, McQueen et al. (1996) and Bae et al. (2012) argue that just because stock prices are able to absorb market-wide information faster than the futures market it is reasonable to believe that the spot market dominates the price discovery process.

Table 4
Correlations. This table reports (unconditional) correlations between equal-weighted country stock returns and country futures market returns. Correlations are estimated for each of the 19 countries and for both weekly and monthly data. The null hypothesis that the correlations are zero is also tested and the resulting *t*-tests are reported.

	Weekly		Monthly	
Countries	Coeff	*t*-Test	Coeff	*t*-Test
US	0.4511	273.81	0.465	136.41
Taiwan	0.4748	134.54	0.5428	77.28
Japan	0.5202	240	0.5572	126.69
South Korea	0.489	109.18	0.5214	56.97
India	0.4331	134.69	0.5416	86.52
Hong Kong	0.2748	44.96	0.3309	26.42
UK	0.4705	152.02	0.4929	77.47
Canada	0.4155	101.42	0.4329	51.06
Malaysia	0.5295	127.6	0.5959	72.69
Thailand	0.3503	58.17	0.4563	38.26
Australia	0.4843	102.47	0.4973	50.79
Indonesia	0.2989	29.74	0.3155	15.08
Poland	0.5218	61.5	0.5941	35.59
Switzerland	0.3413	57.64	0.3245	26.12
South Africa	0.3218	49.73	0.3469	25.94
Turkey	0.6115	85.39	0.6253	42.34
Singapore	0.3664	37.39	0.4566	23.34
France	0.286	41.95	0.2633	18.38
Sweden	0.7395	110.88	0.5226	29.64

Other studies, such as Merton (1987), Basak and Cuoco (1998), Shapiro (2002), and Hou and Moskowitz (2005) indicate that institutional forces and information or transaction costs could influence the price discovery process because these factors can delay the process of information incorporation for less visible markets.

We conclude this section with an analysis of the economic significance of price discovery. We have shown that price discovery in most countries in our sample is dominated by the Islamic spot market. What does this mean for investors? This is the questions we answer next. The way to think about the potential economic significance of our results is as follows. Without having the knowledge on price discovery, it is safe to begin by assuming that the futures market contains all the information and therefore should help predict the spot market. There is a large literature on this line of analysis (see Narayan, 2013). However, now when we know where the price discovery is taking place, it is no longer safe to assume that price discovery takes place in the futures market for all countries. In other words, in markets where the spot prices dictate the price discovery process, spot price information needs to be utilised to forecast the futures market. The message therefore is that once we know which market dominates the price discovery process, then this market can be used as a predictor of returns from the other market. The idea is to test whether profits are higher when using the obtained information on price discovery in forecasting returns. In order to estimate investor profits, we follow the convention in the literature and make the following assumptions: (i) the investor is faced with a mean-variance utility function; (ii) the investor has a two-asset portfolio, one risky asset and one risk-free asset (three-month US Treasury bills), and (iii) the investor allocates her portfolio between these two assets and rebalances the portfolio every month (since our analysis is based on using monthly data). In estimating the portfolio weight, the investor needs: (a) forecasts of excess returns, which are constructed using an in-sample period of 50%; (b) variance forecasts, which we obtain by using a five-year rolling window of monthly returns; and (c) a risk-aversion parameter, which we set to three, representing an investor who undertakes a low level of risk.

The results are presented in Table 7. Column 2 contains profits from a buy-and-hold strategy implemented in both the spot and the futures markets. Column 3 contains two sets of results obtained using the mean-variance utility function. The first set of results restricts the portfolio weight to be between 0 and 1, implying that there is no short-selling and borrowing. The second set of results relaxes this assumption and allows for 50% short-selling and 50% borrowing. The results reported in the last column are the same as those reported in column 3, except that the risk aversion parameter is now set to six (representing an investor who entertains a medium level of risk). In addition to reporting the annualized profits, we also test the null hypothesis that the profits are zero.

Two results are of particular interest here. Let us first consider the seven countries (US, Taiwan, Canada, Indonesia, Turkey, Singapore, and Sweden) for which price discovery is dominated by the futures market. We notice that the profits for the US (9.55%), Taiwan (8.89%) and Turkey (18.83%) are higher than the buy-and-hold profits. For Canada, the buy-and-hold profit is −5.39%, but the mean-variance profit is statistically insignificant and positive (0.29%). For Indonesia, the buy-and-hold strategy leads to a loss of 31.87%, whereas profits obtained for a mean-variance investor indicate a substantially smaller loss at 2.14%. For Singapore, both strategies offer statistically insignificant profits.

Next, consider the 12 countries for which the spot market dominates price discovery. We notice that the mean-variance profits for

Table 5
Price discovery results based on monthly data. This table presents results on price discovery based on monthly data. The table is divided into two panels. The upper panel has results on the stock market, while the lower panel has results on the futures market. While the second column contains the estimated panel PT (PPT) measure, the fourth column contains the results for the panel IS (PIS) measure. The reported *t*-tests test the null hypothesis of no price discovery in the corresponding market.

Country	PPT	*t*-Test	PIS	*t*-Test
Stock market				
US	0.3012	−4.8275	0.0921	−130.1333
Taiwan	0.9971	−8.4485	0.7869	−9.8811
Japan	0.9588	−5.2387	0.8938	−.0160
South Korea	0.0035	−780.7636	0.9678	−1.7388
India	0.9950	−0.1738	0.9703	−1.8558
Hong Kong	0.9992	−2.4730	0.9918	−4.6617
UK	0.9990	−2.5125	0.9381	−3.0688
Canada	0.9720	−6.5709	0.6897	−9.4746
Malaysia	0.9998	−0.2883	0.9148	−3.4271
Thailand	0.9752	−1.8161	0.8815	−2.1276
Australia	0.9977	−3.0607	0.8367	−3.6236
Indonesia	0.9999	−2.8440	0.8709	−2.5500
Poland	0.9927	−0.1807	0.9769	−1.1310
Switzerland	0.9581	−0.3292	0.9890	−0.5046
South Africa	0.9939	−2.6062	0.6570	−3.2168
Turkey	0.9822	−0.5369	0.9693	−3.0717
Singapore	0.9910	−2.0922	0.7582	−2.4804
France	0.9955	−1.4928	0.7894	−1.9567
Sweden	0.7640	−2.0474	0.7724	−2.6856
Futures market				
US	0.6988	4.8275	0.9079	130.1333
Taiwan	0.0029	8.4485	0.2131	9.8811
Japan	0.0412	5.2387	0.1062	7.0160
South Korea	0.9965	780.7636	0.0322	1.7388
India	0.0050	0.1738	0.0297	1.8558
Hong Kong	0.0008	2.4730	0.0082	4.6617
UK	0.0010	2.5125	0.0619	3.0688
Canada	0.0280	6.5709	0.3103	9.4746
Malaysia	0.0002	0.2883	0.0852	3.4271
Thailand	0.0248	1.8161	0.1185	2.1276
Australia	0.0023	3.0607	0.1633	3.6236
Indonesia	0.0001	2.8440	0.1291	2.5500
Poland	0.0073	0.1807	0.0231	1.1310
Switzerland	0.0419	0.3292	0.0110	0.5046
South Africa	0.0061	2.6062	0.3430	3.2168
Turkey	0.0178	0.5369	0.0307	3.0717
Singapore	0.0090	2.0922	0.2418	2.4804
France	0.0045	1.4928	0.2106	1.9567
Sweden	0.2360	2.0474	0.2276	2.6856

South Korea (1.99%), India (8.51%), Hong Kong (5.13%), UK (1.91%), Malaysia (6.43%), Australia (2.46%), Poland (12.86%), Switzerland (7.01%), South Africa (5.59%), and France (3.62%) beat corresponding profits obtained from the buy-and-hold strategy. These results imply that utilizing the information from price discovery in specifying a forecasting model offers investors greater profits compared to a buy-and-hold strategy. For the 12 countries for which the spot market dominates price discovery process, the mean-variance strategy produces an average profit of 4.91% per annum, whereas the 12-country average buy-and-hold profit is only 2.97% per annum. This represents a 62.35% increase in average profits when using the evidence on price discovery to forecast returns. These results are on the whole robust to different risk aversion parameters and to the allowance for both short-selling and borrowing.

4. Concluding remarks

There is no knowledge on whether the price discovery process with respect to Islamic stocks is spot market or futures market driven. This is the subject of our investigation. We compile a unique stock-level dataset covering 900 Islamic stocks belonging to 19 countries. We then form country-wise panels of stock prices and the stock market index futures price. Following this, we measure price discovery within a panel data setting following the proposal of Karabiyik et al. (2016). The evidence we obtain suggests that the price discovery process in most of the 19 countries is dominated by the spot market. At best, in only seven countries it is the futures

Table 6
Price discovery results based on weekly data. This table presents results on price discovery based on weekly data. For further details, see the explanations of Table 5.

Country	PPT	*t*-Test	PIS	*t*-Test
Stock market				
US	0.0751	−3.9961	0.1002	−154.0565
Taiwan	0.9981	−7.2123	0.8599	−8.9569
Japan	0.9650	−3.8660	0.9171	−5.9105
South Korea	0.0026	−967.2097	0.9640	−2.2094
India	0.9355	−2.0284	0.9365	−2.0619
Hong Kong	0.9990	−1.8538	0.9950	−1.7745
UK	1.0000	−0.0290	1.0000	−0.5602
Canada	0.9745	−6.2240	0.7016	−9.0344
Malaysia	0.9984	−2.0893	0.8725	−3.2373
Thailand	0.9853	−1.0192	0.9286	−1.5980
Australia	0.9978	−2.5536	0.8416	−2.9847
Indonesia	0.9999	−3.2727	0.8670	−3.4220
Poland	0.9871	−0.2732	0.9796	−0.9095
Switzerland	0.9418	−0.5311	0.9863	−0.6703
South Africa	0.9944	−2.3881	0.6902	−2.7709
Turkey	0.9308	− 1.5155	0.9562	−2.4304
Singapore	0.9927	−1.8143	0.8405	−1.9455
France	0.9947	−1.8102	0.7500	−2.3944
Sweden	0.9090	−6.4956	0.5812	−16.1447
Futures market				
US	0.9249	3.9961	0.8998	154.0565
Taiwan	0.0019	7.2123	0.1401	8.9569
Japan	0.0350	3.8660	0.0829	5.9105
South Korea	0.9974	967.2097	0.0360	2.2094
India	0.0645	2.0284	0.0635	2.0619
Hong Kong	0.0010	1.8538	0.0050	1.7745
UK	0.0000	0.0290	0.0000	0.5602
Canada	0.0255	6.2240	0.2984	9.0344
Malaysia	0.0016	2.0893	0.1275	3.2373
Thailand	0.0147	1.0192	0.0714	1.5980
Australia	0.0022	2.5536	0.1584	2.9847
Indonesia	0.0001	3.2727	0.1330	3.4220
Poland	0.0129	0.2732	0.0204	0.9095
Switzerland	0.0582	0.5311	0.0137	0.6703
South Africa	0.0056	2.3881	0.3098	2.7709
Turkey	0.0692	1.5155	0.0438	2.4304
Singapore	0.0073	1.8143	0.1595	1.9455
France	0.0053	1.8102	0.2500	2.3944
Sweden	0.0910	6.4956	0.4188	16.1447

market that dominates the price discovery process. We also illustrate the economic significance of the evidence on price discovery. For the 12 countries for which the spot market dominates price discovery, we show, using a mean-variance investor utility function, that the 12-country annualized average profit is 4.91% whereas the 12-country average buy-and-hold profit is only 2.97% per annum. This represents a 62.35% increase in average profits when using the evidence on price discovery to forecast returns.

There are two implications of our empirical findings. The first implication relates to the utilisation of the evidence on price discovery to devise trading strategies. What we show is that the price discovery process with respect to Islamic stocks is not homogeneous; that is, while in some countries the futures market seems to dominate price discovery, in most countries it is the spot market that dominates price discovery. Therefore, the investment strategies at least in the 19 countries we analyse will have to be country-specific. We design trading strategies accordingly and demonstrate the usefulness of the knowledge on price discovery. Subsequently, and to the best of our knowledge, ours is the first paper to develop the connection between the statistical evidence of price discovery and its economic significance. The second implication relates to the fact that in majority of the countries we find the spot market dominating the price discovery process. We are not alone in documenting such a relationship. In commodity markets, for instance, it has been shown that for some commodities it is the spot market that dominates price discovery. The point here is that such a statistical relation is inconsistent with the bulk of the empirical evidence documented in the price discovery literature. Our results though are consistent with the trading volume hypothesis, which associates higher trading volumes in the spot market (compared to the futures market) to a greater role for price discovery in the spot market. The resulting implication, when our results are combined with the broader literature, is that since the evidence in more than one strand of the literature tends to show a dominant role of the spot market over the futures market, it calls for more theoretical work to explain this type of relationship.

Table 7
Mean-variance investor profit. This table reports profits for investors based on a buy-and-hold trading strategy and a mean-variance investor trading strategy. To implement the mean-variance trading strategy, we use the one period lagged spot (futures) returns to forecast the current futures (spot) returns. A 50% in-sample period is used to generate recursive forecasts of returns for the remaining 50% of the sample. Profits are computed based on first estimating the portfolio weight, which is an increasing function of return forecasts and a decreasing function of the return variance and the risk aversion factor. The risk aversion factor equals three and six and the variance is computed using a five-year rolling window of historical returns. The portfolio weight is restricted to be between (a) 0 and 1, implying that there is no short-selling and borrowing, and (b) − 0.5 and 1.5, which allows for 50% short-selling and borrowing. Our portfolio is a two-asset portfolio, where one is a risky asset and the other is a risk-free asset. The portfolio weight is used to decide the proportion of a dollar to be invested in the risky asset (which is wither the spot or futures) and the risk-free asset (which is the three-month bill rate). As is common in this mean-variance setup, we make two assumptions: (i) investors only use public information to forecast the one-period ahead excess returns; and (ii) investors rebalance their portfolio once a month (since we use monthly data). The profits are annualized.

			Risk aversion = 3				Risk aversion = 6			
	Buy and hold		Weight ∈ [0,1]		Weight ∈ [− 0.5,1.5]		Weight ∈ [0,1]		Weight ∈ [− 0.5,1.5]	
Countries	Spot	Futures	Spot	Futures	Spot	Futures	Spot	Futures	Spot	Futures
US	7.755***	2.966***	9.548***	4.789***	13.503***	6.226***	9.575***	4.737***	29.738***	8.750***
Taiwan	7.950***	0.966	8.890***	−1.027***	11.216***	−4.150***	7.638***	−0.481**	9.369***	−3.980***
Japan	7.842***	4.153***	6.187***	1.858***	5.890***	−0.740***	4.904***	1.952***	3.933***	−0.490**
South Korea	8.218***	1.111	7.576***	1.992***	7.819***	1.392***	6.657***	2.693***	7.463***	2.403***
India	14.618***	0.216	23.960***	8.505***	32.117***	9.672***	23.437***	8.183***	30.344***	9.695***
Hong Kong	5.305	3.889***	8.708***	5.132***	13.381***	6.083***	8.525***	3.780***	12.089***	2.574
UK	6.714***	1.665***	10.622***	1.905***	13.984***	0.320	8.184***	0.952**	10.136***	−0.829
Canada	−5.392**	−5.987***	0.290	−6.824***	−0.847	−8.493***	0.349	−4.207***	0.016	−4.072***
Malaysia	12.474***	5.046***	8.997***	6.428***	8.895***	7.624***	7.786***	6.130***	6.139***	6.902***
Thailand	9.288***	−0.289	14.663***	1.529	21.906***	0.754	15.830***	1.984	22.899***	1.625
Australia	−4.826	−3.919***	4.260***	2.458***	5.426***	2.565***	4.515***	3.156***	5.117***	3.267***
Indonesia	−31.868***	−0.569	−2.144	3.879***	4.065	0.634	0.247	3.553***	6.214*	2.237*
Poland	14.883***	12.096***	16.873***	12.860***	24.131***	16.242***	16.872***	12.187***	23.170***	15.190***
Switzerland	12.009***	6.342***	15.331***	7.008***	22.669***	10.150***	15.302***	7.005***	20.621***	9.877***
South Africa	−5.826**	3.286*	7.966***	5.594***	11.721***	2.598***	8.839***	6.114***	11.429***	3.849***
Turkey	−0.913	−9.428***	18.833***	5.666***	28.133***	8.311***	17.351***	7.073***	26.774***	9.854***
Singapore	0.384	−1.947	1.437	−0.192	2.175	−0.497	1.217	−0.695	0.762	−1.549
France	8.216***	2.093	9.636***	3.624**	13.195***	4.230*	8.727***	3.259**	9.385***	3.619
Sweden	9.424***	3.114	7.572***	1.756	9.066***	1.242	6.118***	1.403	6.513**	0.592

*** Denotes the statistical significance at the 1% level.
** Denotes the statistical significance at the 5% level.
* Denotes the statistical significance at the 10% level.

References

Abdelsalam, O., Fethi, M., Matallin, J., Tortosa-Ausina, E., 2014. On the comparative performance of socially responsible and Islamic mutual funds. J. Econ. Behav. Organ. 103, S108–S128.
Al-Khazali, O., Lean, H., Samet, A., 2014. Do Islamic stock indexes outperform conventional stock indexes? A stochastic dominance approach. Pac. Basin Financ. J. 28, 29–46.
Ashraf, D., Mohammad, N., 2014. Matching perception with the reality-performance of Islamic equity investments. Pac. Basin Financ. J. 28, 175–189.
Azmat, S., Skully, M., Brown, K., 2014a. The Shariah compliance challenge in Islamic bond markets. Pac. Basin Financ. J. 28, 45–57.
Azmat, S., Skully, M., Brown, K., 2014b. Issuer's choice of Islamic bond type. Pac. Basin Financ. J. 28, 122–135.
Azmat, S., Skully, M., Brown, K., 2015. The (little) difference that makes all the difference between Islamic and conventional bonds. Pac. Basin Financ. J. http://dx.doi.org/10.1016/j.pacfin.2015.12.010.
Bae, K.H., Ozoguz, A., Tan, H., Wirjanto, T.S., 2012. Do foreigners facilitate information transmission in emerging markets? J. Financ. Econ. 105, 209–227.
Basak, S., Cuoco, D., 1998. An equilibrium model with restricted stock market participation. Rev. Financ. Stud. 11, 309–341.
Belanes, A., Ftiti, Z., Regaige, R., 2015. What can we learn about Islamic banks efficiency under the subprime crisis? Evidence from GCC region. Pac. Basin Financ. J. 33, 81–92.
Bohl, M.T., Salm, C.A., Wilfing, B., 2009. Do individual index futures investors destabilize the underlying spot market? J. Futur. Mark. 31, 81–101.
Brennan, M.J., Jegadeesh, N., Swaminathan, B., 1993. Investment analysis and the adjustment of stock prices to common information. Rev. Financ. Stud. 6, 799–824.
Cabrera, J., Wang, T., Yang, J., 2009. Do futures lead price discovery in electronic foreign exchange markets? J. Futur. Mark. 29, 137–156.
Chen, Y.L., Gau, Y.F., 2009. Tick sizes and relative rates of price discovery in stock, futures, and options markets: evidence from the Taiwan Stock Exchange. J. Futur. Mark. 29, 74–93.
Chordia, T., Swaminathan, B., 2000. Trading volume and cross-autocorrelations in stock returns. J. Financ. 55, 913–935.
Dolatabadi, S., Nielsen, M.O., Xu, K., 2015. A fractionally cointegrated VAR analysis of price discovery in commodity futures markets. J. Futur. Mark. 35, 339–356.
Engle, R.F., Granger, C.W., 1987. Co-integration and error correction: representation, estimation, and testing. Econometrica 251–276.
Gonzalo, J., Granger, C., 1995. Estimation of common long-memory components in cointegrated systems. J. Bus. Econ. Stat. 13, 27–35.
Hasbrouck, J., 1995. One security, many markets: determining the contributions to price discovery. J. Financ. 50, 1175–1199.
Hou, K., 2007. Industry information diffusion and the lead-lag effect in stock returns. Rev. Financ. Stud. 20, 1113–1138.
Hou, K., Moskowitz, T.J., 2005. Market frictions, price delay, and the cross-section of expected returns. Rev. Financ. Stud. 18, 981–1020.
Ibrahim, M.H., 2015. Issues in Islamic banking and finance: Islamic banks, Shari'ah-complaint investment and sukuk. Pac. Basin Financ. J. 34, 185–191.
Johnes, J., Izzeldin, M., Pappas, V., 2014. A comparison of performance of Islamic and conventional banks 2004–2009. J. Econ. Behav. Organ. 103, S93–S107.
Karabiyik, H., Westerlund, J., Narayan, P., 2016. Panel Dat Measures of Price Discovery. Unpublished manuscript.
Kenourgios, D., Naifar, N., Dimitriou, D., 2016. Islamic financial markets and global crises: contagion or decoupling? Econ. Model. 57, 36–46.
Lo, A.W., MacKinlay, A.C., 1990. When are contrarian profits due to stock market overreaction? Rev. Financ. Stud. 3, 175–205.
Mallin, C., Farag, H., Ow-Yong, K., 2014. Corporate social responsibility and financial performance in Islamic banks. J. Econ. Behav. Organ. 103, S21–S38.
Merton, R.C., 1987. A simple model of capital market equilibrium with incomplete information. J. Financ. 42, 483–510.
McQueen, G., Pinegar, M., Thorley, S., 1996. Delayed reaction to good news and the cross autocorrelation of portfolio returns. J. Financ. 51, 889–919.

Narayan, P.K., Narayan, S., Sharma, S.S., 2013. An analysis of commodity markets: what gain for investors? J. Bank. Financ. 37, 3878–3889.
Narayan, P.K., Bannigidadmath, D., 2015. Does financial news predict stock returns? New evidence from Islamic and non-Islamic stocks. Pac. Basin Financ. J. http://dx.doi.org/10.1016/j.pacfin.2015.12.009.
Narayan, P.K., Narayan, S., Phan, D.H.B., Thuraisamy, K., Tran, V., 2015. Credit quality implied momentum profits for Islamic stocks. Pac. Basin Financ. J.http://dx.doi.org/10.1016/j.pacfin.2015.11.004.
Narayan, P.K., Phan, D.H.B., 2016). Momentum strategies for Islamic stocks. Pac. Basin Financ. J. http://dx.doi.org/10.1016/j.pacfin.2016.05.015.
Narayan, P.K., Phan, D.H.B., Sharma, S.S., Westerlund, J., 2016a. Are Islamic stock returns predictable? A global perspective. Pac. Basin Financ. J. 40, 210–223.
Narayan, P.K., Phan, D.H.B., Thuraisamy, K., Westerlund, J., 2016b. Price discovery and asset pricing. Pac. Basin Financ. J. 40, 224–235.
O'Hara, M., 2003. Presidential Address: liquidity and price discovery. J. Financ. LVIII 1335–1354.
Pizzi, M.A., Economopoulos, A.J., O'Neill, H.M., 1998. An examination of the relationship between stock index cash and futures markets: a cointegration approach. J. Futur. Mark. 18, 297–305.
Rahim, A.M., Masih, M., 2016. Portfolio diversification benefits of Islamic investors with their major trading partners: evidence from Malaysia based on MGARCH-DCC and wavelet approaches. Econ. Model. 54, 425–438.
Shapiro, A., 2002. The investor recognition hypothesis in a dynamic general equilibrium: theory and evidence. Rev. Financ. Stud. 15, 97–141.
Shaban, M., Duygun, M., Fry, J., 2016. SME's lending and Islamic finance: is it a win-win situation? Econ. Model. 55, 1–5.
Shamsuddin, A., 2014. Are Dow Jones Islamic equity indices exposed to interest rate risk? Econ. Model. 39, 273–281.
Yilmaz, M., Sensoy, A., Ozturk, K., Hacihasanoglu, E., 2015. Cross-sectoral interactions in Islamic equity markets. Pac. Basin Financ. J. 32, 1–20.